Toy Sample Dataset Sample Using Perceptron Model

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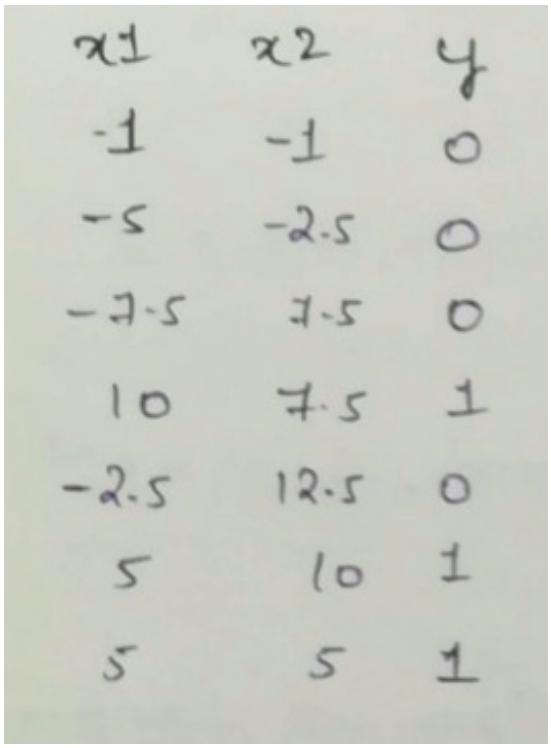
> **Disclaimer: This is notes on "Toy Sample Dataset" Lesson (PadhAI onefourthlabs course "A First Course on Deep Learning")**

Here we will solve a Toy sample a dataset using the Perceptron Learning Algorithm.

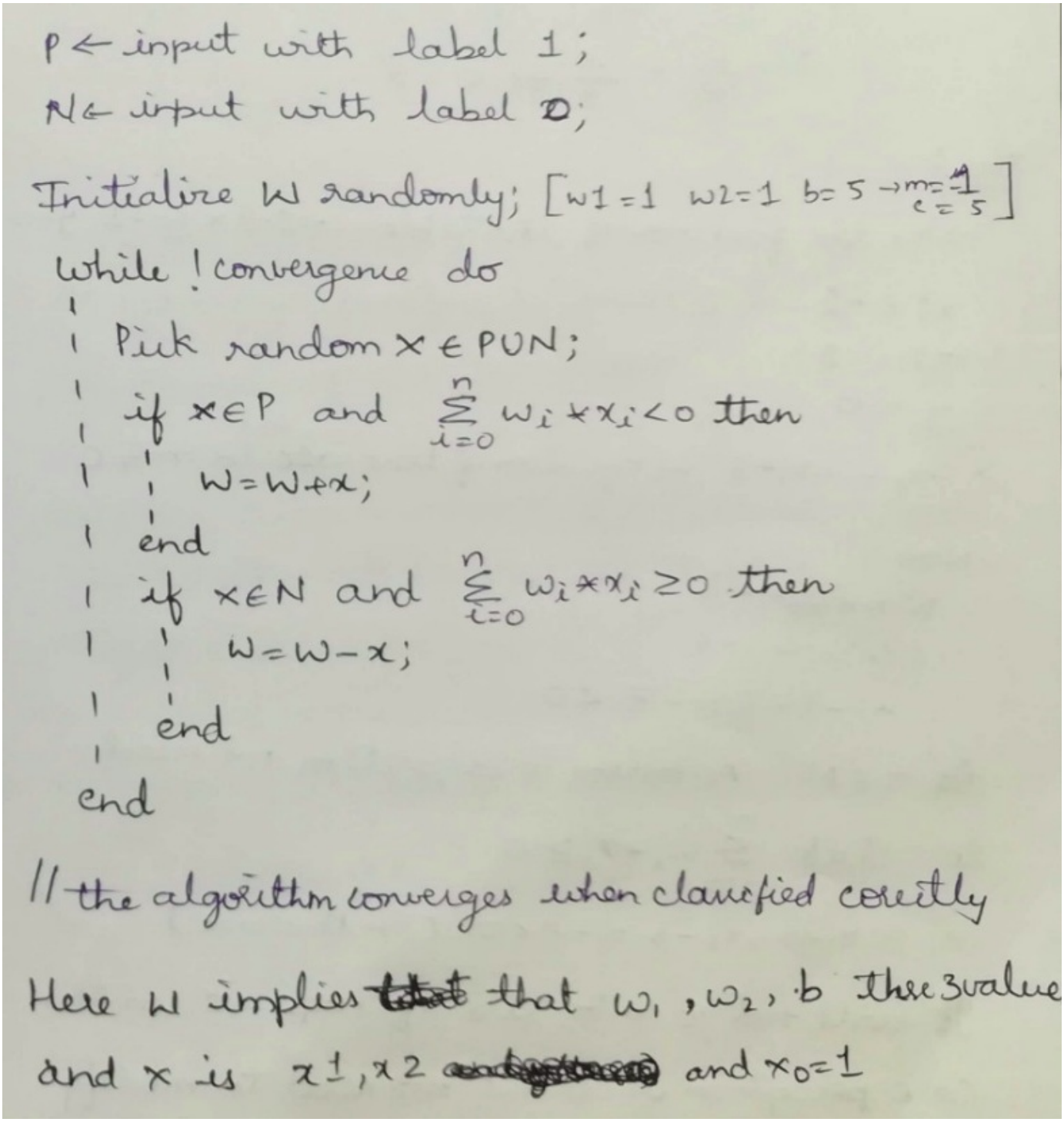
Toy Data-set

The Small Dataset we use is as beside x1 and x2 we are the inputs and y is the output.That's is the true value and we have 7 rows that is mainly 7 cases and we will need to predict the values using the perceptron learning Algorithm.



x1	x2	y
-1	-1	0
-5	-2.5	0
-7.5	7.5	0
10	7.5	1
-2.5	12.5	0
5	10	1
5	5	1

We have our perceptron Learning Algorithm as follows:



Perceptron learning Algorithm.

Next we start the initialising w1,w2 and start iterating through out the data. We will discuss this in different steps.

Now randomly choosen W is $w1=1$ $w2=1$ $b=5.00$

accordingly $m = -\frac{w_1}{w_2} = \frac{-1}{1} \Rightarrow m=1$

$$c = \frac{b}{w_2} = \frac{5}{1} \Rightarrow c = 5$$

step 1 :-

Take the first row of the table $x1=-1$ $x2=-1$ $y=0$

$x1 = -1$

$x2 = -1$

$y = 0$

$\therefore x_2 = -x_1 + 5$ is equation of Line according to m & c

Now

$w_1x_1 + w_2x_2 - b$

$1(-1) + 1(-1) - 5$

$-1 - 1 - 5 = -7 < 0$

As $x \in N$ According to algorithm we need to check $\sum_{i=0}^{n} w_i * x_i \geq 0$

as $w_1x_1 + w_2x_2 - b = -7 < 0$ (In this case)

It will not go into the if loop. so in this case perceptron is correct no need to modify the weights

step 2 :-

Take the second row of values

$x1 = -5$ $x2 = -2.5$ $y = 0$

$w_1x_1 + w_2x_2 - b$

$1(-5) + 1(-2.5) - 0$

$-5 - 2.5 - 0 = -7.5 < 0$

again perceptron is doing a good job as $x \in N$

step 3 :-

Same thing happens for the 3rd row it classifies correctly.

step 4 :-

Consider 4th row $x1=10$ $x2=7.5$ $y=1$

$x \in P$

$(1)(10) + 1(7.5) - 5$

$10 + 7.5 - 5$

$17.5 - 5 = 12.5 > 0$

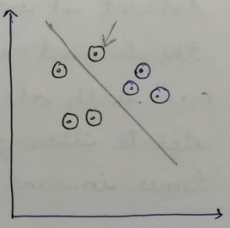
As $x \in P$ we need to check $\sum_{i=0}^{n} w_i * x_i < 0$

as here it is $12.5 > 0$ no need to update weights perceptron is correctly classifying

step 5 :-

Take the 5th row of the table where

$x1 = -2.5$ $x2 = 12.5$ $y = 0$



$w_1x_1 + w_2x_2 - b$

$\Rightarrow (1)(-2.5) + 1(12.5) - 5$

$\Rightarrow 5 > 0$

$x \in N$ and $\sum_{i=0}^{n} w_i x_i \geq 0$

Now the perceptron had made a mistake now we need to update the weights

$W = W - X$

$$\begin{bmatrix} W_2 \\ W_1 \\ W_0 \end{bmatrix} = \begin{bmatrix} W_2 \\ W_1 \\ W_0 \end{bmatrix} - \begin{bmatrix} x_2 \\ x_1 \\ 1 \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 5 \end{bmatrix} - \begin{bmatrix} 12.5 \\ -2.5 \\ 1 \end{bmatrix}$$

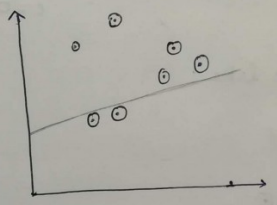
$$\begin{bmatrix} W_2 \\ W_1 \\ W_0 \end{bmatrix} = \begin{bmatrix} -11.5 \\ 3.5 \\ 4 \end{bmatrix}$$

Newly $w_1 = 3.5$ $w_2 = -11.5$ $b = 4$ $m = 0.30$ $c = -0.35$

Now equation is

$x_2 = 0.30x_1 - 0.35$

Now the present graph is



It wrongly classifies 2 values now it not like if we update the weight one everything will be fine. so follow process again

step 6 :-

Go to the 6th row of the Table

$x1 = 5$ $x2 = 10$ $y = 1$

$w_1x_1 + w_2x_2 - b$

$(3.5) * 5 + -11.5(10) - 4 < 0$

As $x \in P$ we need to make a correction now

$W = W + X$

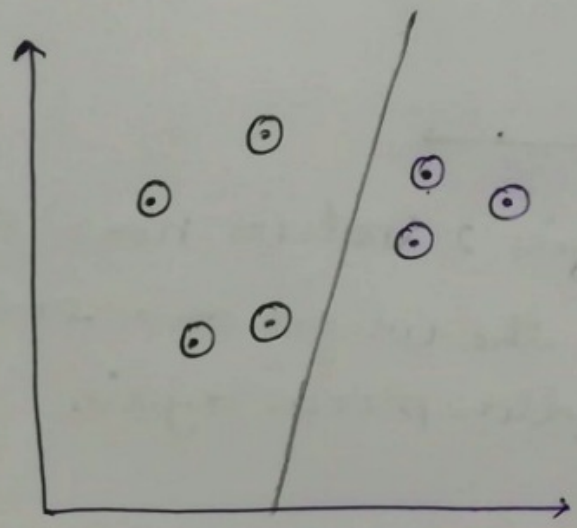
$$\begin{bmatrix} W_1 \\ W_2 \\ W_0 \end{bmatrix} = \begin{bmatrix} W_1 \\ W_2 \\ W_0 \end{bmatrix} + \begin{bmatrix} x_2 \\ x_1 \\ 1 \end{bmatrix} = \begin{bmatrix} 3.50 \\ -11.50 \\ 4 \end{bmatrix} + \begin{bmatrix} 5 \\ 10 \\ 1 \end{bmatrix}$$

$$\begin{bmatrix} W_1 \\ W_2 \\ W_0 \end{bmatrix} = \begin{bmatrix} 8.50 \\ -1.50 \\ 5 \end{bmatrix}$$

New $w_1 = 3.50$ $w_2 = -1.50$ $b = 4.00$ $m = 0.30$

$c = 0.35$

Now the model will be like



By the way taking lastly 7th row of table

$x1 = 5$ $x2 = 5$ $y = 1$

$\therefore$ $w_1 x_1 + w_2 x_2 + b > 0 \Rightarrow 3.50(5) - (1.50)(5) + 4 > 0$

$\therefore$ no need to correct the values

$\therefore$ our model fully converges now

Actually in this small toy example dataset it was enough if go if go through if go through out the data at once but it it will not be the case with all datsets we need to iterate though out the datasets we need to iterate through out the whole many times in some data sets.

Therefore, The Perceptron Learning Algorithm is shown on the Toy data Set.

This is a small try, uploading the notes . I believe in “**Sharing knowledge is that best way of developing skills**”.Comments will be appreciated. Even small edits can be suggested.

> **Each Applause will be a great encouragement.**

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